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Multi-Brand Pricing as a Strategy for Consumer Search Obfuscation in Online Markets

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Abstract

This paper argues that a firm with multiple brands can obfuscate consumer search by excluding the brands of other firms from a consumer's consideration set. This is examined empirically by regressing price data for a leading UK motor insurance price comparison site (or 'shopbot'). It finds that multi-brand firms own three-quarters of brands in this market, and that allowing for other brand strategies they post significantly lower and clustered prices relative to other firms. The firms also conceal their brand ownership, consistent with search obfuscation. The results are not otherwise explained and they have implications for market competitiveness.

Key words: Search obfuscation, multiple price posting, online markets, price comparison websites.

JEL Classification codes: L11, D83 L81 and G22.

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1. Introduction

It has long been recognised that consumer search costs give firms market power (Scitovsky, 1950), but it is only recently that search obfuscation strategies have been considered as a way to endogenize these search costs. To gain a competitive advantage, the firm can either reduce the effectiveness of consumer search (e.g., Wilson, 2010; Ellison and Wolitzky, 2012) or it can influence the alternatives that consumers perceive as relevant to a purchase decision (Spiegler, 2011; Piccione and Spiegler, 2012). The interest in search obfuscation reflects the growth of online markets, which has reduced search costs and led firms to strategically innovate (Ellison and Ellison, 2009). However, despite a burgeoning literature on this topic, there has been little empirical exploration of search obfuscation. To our knowledge, Muir *et al*. (2013) is one of the few studies that have explored this issue empirically, but this is in the context of an offline market in which there is a non-standardized reporting of prices and the consumers incur physical costs in visiting sellers. This paper remedies this deficiency in the literature by investigating consumer search obfuscation empirically for an online market.

Broadly, search obfuscation models are of two types. One stream of the literature assumes consumers are rational and can correctly infer all prices, so that it focuses on devices like product 'add-ons' that are revealed only at the time of purchase (Ellison, 2005; Gabaix and Laibson, 2006; Seim *et al*., 2017). These and other pricing strategies are a strong focus for research in the marketing literature, which is surveyed by Ahmetoglu *et al*. (2014). The other stream supposes consumers are boundedly rational, and it considers framing and pricing strategies that either confuse the consumer (Chioveanu and Zhou, 2012; Seim *et al*., 2016) or lead to the adoption of simple heuristics (e.g., Spiegler, 2006). In this latter case, Eliaz and Spiegler (2011) suppose firms use marketing devices to influence the alternatives that the consumers include in their consideration sets. These sets are used by consumers to reduce the

number of options to a manageable size, from which a choice is made after further research. Consideration sets are recognised as a screening device in the marketing literature (Howard and Sheth, 1969), and more recently they are a feature of online markets in which consumers form consideration sets using the lowest-ranked prices or the first page of search results from an Internet comparison site (Masatlioglu *et al.*, 2012).[1] The marketing devices considered by Eliaz and Spiegler (2011) include comparative advertising, salespersons, product positioning and search engine optimization, but these devices are likely to work much less well in online markets if consumers base their consideration sets on the lowest-ranked prices.

This paper considers an alternative strategy for influencing the consumer choice in an online market, which is where a firm uses multiple brands to 'load' the consideration set with its own brands and obfuscate consumer search by not revealing its ownership of these brands. Firm ownership is relevant to the purchase decision since it signals reputation and trust in a brand (Cabral, 2000), and if it is known then it might cause a consumer to swiftly discount all but the cheapest brand from the seller when the product is otherwise similar. Search obfuscation occurs as the concealment of the ownership deceives consumers into unwittingly excluding the brands of other firms from their consideration sets. It has features of both types of search obfuscation model, since it involves bounded rationality (consideration sets) and the non-disclosure of relevant information (ownership). Further, it is feasible as a website can be created for a new brand at only a modest outlay, while the cost of reaching consumers is also low due to the use of comparison sites. Ellison and Ellison (2009) find that retailers operate multiple sites to sell the same product range, but their empirical results are about add-ons that are used by firms to lure-in price sensitive consumers to consider superior products.

This paper explores multi-brand pricing as a strategy for search obfuscation by taking data for a price comparison website or 'shopbot' in which there is a standardized reporting of

[1] Consideration sets and the related literature are discussed in Brynjolfsson *et al*. (2010).

prices and other policy attributes. The examination is for a leading UK motor insurance price comparison site, which (ironically) is called *confused.com*. Like other UK motor insurance sites, in response to an online enquiry the quotes are reported in ascending price order, with information presented on the premium and other policy attributes. The prices in this market are consumer-specific, and the data are collected for 22 individual types, by age, occupation and sex, for each of 5 car types, giving 110 'sub-markets'. This is at four dates, so that there are 440 'price sets' and a total of 28,327 observations on prices. These data are examined as a price rank for each price set. The regression analysis seeks to determine if the multi-brand firms post prices that are both low and clustered relative to the single-brand firms.

The paper finds that sixteen multi-brand firms own three-quarters of the brands in this market. These firms pursue different strategies with at least some of their brands, including horizontal differentiation and market segmentation, but allowing for these the analysis shows that they post prices that are both relatively low and clustered. This is not due to unobserved heterogeneity at either a brand or firm level, such as from common costs or risks. Rather, as only one firm openly declares its brand ownership, it is believed to reflect search obfuscation, with firms seeking to increase the probability that their product is chosen. It points to a new form of strategic behaviour that has implications for the competitiveness of online markets. Further, as firms can post prices with ease and firm ownership is opaque in online markets, it suggests that this kind of behaviour is may be pervasive in e-commerce.

The structure of the paper is as follows. The next section sets out the hypotheses and considers the identification strategy for ruling out alternative motives for multi-brand pricing. Section 3 describes the UK motor insurance market, the *confused.com* website and the data collection. Section 4 considers the unconditional pricing behaviour of the multi-brand firms, and section 5 presents the regression results. Finally, section 6 concludes.

2. Multi-Brand Pricing

To our knowledge, Ireland (2007) is the only paper that formally models multi-brand pricing as a strategy for consumer search obfuscation. Multiple-price posting occurs as pairs of firms pursue joint profit-maximization, but do not disclose this to consumers. This is advantageous to the joint-firm as it can capture those consumers who sample both of its prices only, and to whom it can charge a higher price. The model is stylized, since consumers search randomly at an *ex ante* fixed sample size of either one or two prices only, where the prices are the same for the joint-firm. There is no consideration set in this model, but consumer search is similar since if a firm is not included in the fixed sample then its price is not transacted. However, there are features of this model that make it inappropriate for an online market.

In particular, search obfuscation in the Ireland model implies that it is necessary to exclude all other firms from a consumer's searched sample, but this is infeasible in an online market where a consumer can search a very large number of brands at a low cost and there is strong competition between firms. Further, in an online market the consumers do not choose their consideration sets (or fixed samples) randomly, but rather they use criteria to form these sets (Dulleck *et al*., 2011; Ratchford, 2009). This may involve a ranking of products such as the lowest prices or the first page of results from an Internet search engine (Masatlioglu *et al.*, 2012). If consumers use the lowest prices on a comparison site to form their consideration sets then it is also no longer possible to exploit consumers by charging higher prices. Indeed, the evidence for online markets is that sales are distributed amongst the lowest posted prices (Baye *et al*., 2009), so that a firm must set its prices low to be included in a consideration set. Under a uniform distribution of prices and a low level of search costs, Stigler (1961) observes that low-price sellers are likely to attract high-volume sales. In fact, charging a lower price to gain more revenue is a standard argument in the search literature, and this is supported by the

strongly negative price elasticities that are found by Ellison and Ellison (2009).

All of this suggests that to exclude either some or all of the brands of the other firms from the consideration set a firm must not only post multiple brands, but if this set is formed using the lowest-ranked price then it must price its brands relatively low and cluster them, so that they have a similar price rank. Further, if the brand ownership reveals information about the brand that would otherwise cause consumers to disregard all but the lowest-priced brand from a seller with similar product attributes, then the firm must conceal this information from the consumer, so that it can obfuscate search. This leads to the following hypotheses:

Hypotheses: *A firm posting multiple prices under different brand names obfuscates consumer search if relative to other firms it*: H1: *posts lower prices*; *and* H2: *clusters these prices*; *and it* H3: *conceals from consumers information about its brand ownership.*

These are necessary conditions for search obfuscation, but they are not sufficient since there is no guarantee that low and clustered prices will be included in a consumer's consideration set. This depends on the size of the set and, in turn, on the level of search that is undertaken, which varies across consumers (De Los Santos, 2008; McDonald and Wren, 2016). Hauser and Wernerfelt (1990) find that the size of the consideration set is between 2 and 5 brands and Honka (2014) that on average a consumer collects 2.4 motor insurance quotes. For an online market the experimental evidence is that the consideration set size is about five brands (Punj and Moore, 2009). Ownership conveys information about reputation and trust, and its disclosure is likely to overcome any branding effect since we find below that the multi-brand firms spend relatively little money in advertising the majority of their brands.

Of course, it is not possible for every firm to pitch its brands in the consideration set, but online markets are dynamic with high entry and exit (Haynes and Thompson, 2013) and the UK motor insurance market is competitive (CMA, 2014), so that being among the lowest

prices increases the likelihood that a brand is considered by the consumer. Further, while a brand can be created at only a modest outlay, the likely benefit of multi-brand pricing must be weighed against the cost of greater organisational complexity from administering multiple brands (Barroso and Giarratana, 2013). In practice, this means that firms are likely to pursue different strategies. Some will have multiple brands for the purpose of search obfuscation but others may have a single brand to give them greater flexibility, perhaps posting a high price in order to capture those consumers that randomly sample a single brand only. Further, as we see, firms may use at least some of their brands for other strategic purposes.

2.1 Identification strategy

Hypotheses H1 and H2 are tested both through statistical and regression analyses, while H3 is examined by inspection of the *confused.com* price comparison website to see if the ownership of the brands is concealed. In the former case the rank of each price observation in a price set is determined and this is regressed on a range of variables, including a dummy for whether a price relates to a multi-brand firm or not. A similar dummy is included on the error variance, so that it is possible to examine if multi-brand firms posts both lower and clustered prices. In the absence of search obfuscation, and controlling for the other effects that are related to firm strategy and product attributes, it is expected that the price rankings for the multi-brand firms will not differ significantly from that of single-brand firms. Differences in pricing according to the hypotheses will therefore indicate that there is search obfuscation.

Of course, there may be alternative explanations for multi-brand pricing, but these are either dismissed at the outset, controlled for in the study design or are tested for. First, multi-brand pricing may just be a form of entry deterrence from brand proliferation (Schmalensee, 1978), but this can be dismissed since the UK online motor insurance does not have attributes that define ‘distance’ in either the product characteristics or seller location. Further, to deter

entry the firms would have to openly declare their ownership, but we do not find this below, while each firm has a small market share. Second, scale economies could mean that a multi-brand firm pitches its brands at the lower prices only in a price set, but a term is included to control for this. Finally, price discrimination across the individual or car characteristics could influence pricing behaviour (Wolinsky, 1987), but the pattern of prices is explored within a price set in which each of these characteristics is held constant. While a multi-brand firm could discriminate by vertically differentiating its brands within a price set, by study design the brands of the same seller are excluded if they are differentiated in quality and ownership is readily identifiable. In fact, only three firms differentiate their brands in this way.

Notwithstanding the controls and study design, some or all of the hypotheses may be consistent with other explanations, so that these are subject to our testing. First, certain of the brands may appeal to certain demographic groups (Vorhies *et al.*, 2009), and this unobserved brand heterogeneity could result in similar prices being posted across the brands, while firm ownership may also be concealed to maintain the brand identity. In this case H2 and H3 would be satisfied, but since it is apparent throughout the price distribution we would expect to reject H1. A second possibility is that there is unobserved firm heterogeneity that leads a multi-brand firm to pitch its brands at a similar price rank, so that H2 would be satisfied. This could arise if a firm's brands have the same cost structure or the ownership of multiple brands informs a firm on where best to pitch each price. In the context of motor insurance it may even be that a firm holds a common belief about risk across its brands. However, in this case we would expect the clustering to be apparent throughout the price distribution, and so we can test for this.

3. The UK Online Motor Insurance Market

The launch of price comparison websites in the early 2000s caused a fundamental shift in the

nature of the UK motor insurance market, and now more than half of consumers purchasing motor insurance online do so using a comparison website (Mintel, 2012). This was the latest change in selling motor insurance. Prior to the mid-1980s insurance was sold to households through high-street brokers, but following deregulation it was sold by telesales. This includes direct selling by underwriters, new firms entering the market to underwrite insurance policies and financial service firms diversifying into this market in collaboration with insurers. Direct selling made consumer search less effective as the purchase of insurance by telephone meant a smaller set of firms were sampled compared to an insurance broker, while the firms were able to horizontally differentiate their brands by targeting particular groups, such as females or inexperienced drivers, leading to the introduction of multi-brand insurers.

The Internet reduced search costs and it is now a mature market with about two-thirds of UK motor insurance policies sold online (Mintel, 2012). Price comparison site coverage of this market is high as the four main sites list between them virtually every insurer (only two large UK firms choose not to voluntarily list their brands). Each comparison site has a similar business model since they generate their revenue from commission and do not accept sponsorship. This is by click-through to the seller's website or by telesales using a reference number. The market is competitive with strong rivalry and it is characterised by a low level of concentration (CMA, 2014). This is in part because a firm can establish a web presence at low cost and reach many consumers. This includes the brokers and underwriters that were previously left behind by the direct sellers. The cost of establishing a brand is also reduced, so that the number of multi-brand firms has grown markedly. These include 'affinity deals', whereby an insurer offers a motor insurance brand in the name of a well-known firm that has strong name recognition but no real experience of this market (e.g., a bank or retailer). The growth of the multi-brand firms is not a result of mergers and acquisitions.

3.1 The 'confused.com' website

The *confused.com* price comparison website covers about 95% of the firms selling UK motor insurance online. It was the market leader at the time that our data were collected with a 25% share. It is believed to be representative of the motor insurance market as a whole with price-parity clauses restricting the prices that can be quoted through other sales channels.[2] Like the other UK motor insurance price comparison sites, a consumer wishing to use *confused.com* to search for motor insurance must first enter their personal, car, driving history and coverage specifications into a series of online windows. These coverage details are the insurance start date and drop-down boxes for the car use (e.g., social & commuting or business), no-claims bonus protection history (e.g., years), coverage required (e.g., comprehensive or third-party), annual mileage and excess, i.e., the deductible in the event of an insurance claim. This is the voluntary excess, but as part of the search results an insurer may specify a compulsory excess that is in addition to this. These details are held constant for each price set in our data.

In response to such an enquiry, *confused.com* gathers the prices from the websites of the insurers that choose to list on its site and reports these in ascending price order on a single page, which the consumer can then scroll down. A sample screen shot of the default display is presented in Figure 1. This shows that for each insurer it gives the brand name / logo, the premium amount (annual and monthly), excess amounts and whether each of the following four policy attributes are included: a courtesy car and insurance cover for each of legal fees, breakdown and windscreen damage. These attributes are not pre-specified by the consumer, and if the premium does not include them Figure 1 shows that *confused.com* gives the price for providing them, although not always. The product attributes are displayed with the quote

[2] The vast majority of policies sold through these sites are subject to 'most-favoured nation' clauses, whereby a brand cannot be sold at a lower price through another channel, including other comparison sites (CMA, 2014). Similar websites exist elsewhere in Europe. Use of these price comparison websites is less common in the US motor insurance market, although *confused.com*'s sister company *compare.com* has operated there since 2013.

alongside the premium, so that they are not an attempt to obfuscate consumer search by add-ons (Ellison, 2005), and may simply be a form of product differentiation.

Figure 1 shows that a consumer can filter the search results according to the inclusion of a courtesy car, breakdown and windscreen cover, the total and voluntary excess and for the coverage required. However, whichever way the search results are filtered they continue to be reported in ascending price order, which is consistent with the lowest-searched price being used by the consumer to form the consideration set. Unlike other sites where the first page of results might form this set (e.g., *Google*) the results are always on a single page and so it does not give a natural size to the consideration set. Figure 1 shows that the brands do not disclose ownership, and this is when the consumer is forming the consideration set. Some brands are obviously linked, e.g., the Hastings brands in Figure 1, but these are vertically differentiated. Figure 1 shows that the consumers can click-through at a second stage to evaluate each brand. It involves inspecting the attributes, such as those that are presented alongside the premium. At this stage a consumer can inspect the small-print to see who underwrites the insurance, but even this is often insufficient to determine the brand ownership. Changes have been made to the *confused.com* site over time, but these essential features remain in place.[3]

3.2 Data collection

The data were collected from the *confused.com* website at four six-weekly intervals between January and July 2011. They were obtained by taking-on identities for 110 motor insurance 'sub-markets' with respect to 22 individual types by age, occupation and sex, and 5 car types.[4]

[3] The major change is that the filtering can now be made on the voluntary excess, payment timing and coverage only, but the results are still presented in ascending price order on a single page. A link exists under the logo labelled 'about provider', but it is still necessary to inspect the small-print to potentially discover ownership. A search on the current site using one of the author's characteristics reveals that the eight lowest-priced brands are owned by just three firms, so that search obfuscation still appears to be an important issue.

[4] These are for four ages: 25, 40, 55 and 70 years; four occupations: blue-collar, white-collar, unemployed and retired; and for each sex. Not all ages and occupations are matched (a retired can be aged 55 or 70, while a 70-

In each case the policy details were selected to reflect average market conditions of a fully-comprehensive level of insurance cover for a married individual with no children, and so on.[5] Details of the other product attributes were gathered, including the compulsory excess and included insurance cover.[6] Each policy is potentially contractible. Over the four dates there are 28,327 observations on 440 'price sets', which is a mean of 64 prices per price set, varying between 44 and 79 prices (standard deviation of 7.4). Eighty-three brands post a price in at least one of the 440 price sets, and *confused.com* displays at most a single price for each brand in any price set. Ten brands entered and two brands exited over our time period, each of which is a single-brand firm. Three firms owned vertically differentiated brands, and the motor insurance quotes were collected for the brand closest to the market standard.[7]

3.3 The multi-brand firms

Table 1 shows that there are 83 brands and 37 firms. Of these, 21 are 'single-brand firms', in that their brand does not share ownership with any other brand posted on *confused.com*. The other 62 brands (75%) are owned by the 'multi-brand firms', of which there are sixteen. One multi-brand firm, MMA Group, openly declares its ownership, which requires click-through, but the information necessary to identify the ownership of the other 57 brands is not readily available. For this, it was necessary to consult industry publications, annual reports and the firms' own websites, which was an arduous and time-consuming task. It is not plausible that

year old is retired), giving 22 individual types. The five cars are the highest-selling model in each major market segment: Ford Fiesta Encore, Ford Focus Zetec, Vauxhall Vectra CD 16V, BMW 525i and Mazda MX-5.

[5] The other policy details are a resident homeowner who has held a licence since age 18 years, an annual travel of 9,000 miles, no motoring convictions and a 5-years no-claim bonus. The policy covers business, commuting and social use, but no other cars, additional drivers, alarm, mobilizer, tracker or modifications. It is for a single address in Newcastle-upon-Tyne with a median UK house price value. The voluntary excess amount was set to zero, and so was the no-claim bonus protection. Certain details that are confined to the small-print could not be held constant, but for all practical purposes the policies are homogeneous in these other characteristics.

[6] There is no relationship between the price and the excess ($r = 0.01$; $p = 0.48$).

[7] For example, the Hastings firm offers Hastings Direct, Hastings Premier and Hastings Essential. The second has a courtesy car as standard and the third has no add-ons. Only the Hastings Direct brand is included.

a consumer would undertake a similar search, which in any event would not be perceived as relevant if the consumer believes that the brands are independent. Overall, we conclude that the multi-brand firms conceal their ownership, which offers support for hypothesis H3.

Table 1 shows that about half of the multi-brand firms have two or three brands, and that the remainder have up to six brands. The exception is the BGL Group, which has twelve brands, of which nine are affinity deals. Ageas and BDML also have affinity deals, but no single-brand firm has these.[8] Table 1 shows that the multi-brand firms may engage in activity other than search obfuscation, such as market segmentation. In particular, the second column of Table 1 shows that virtually every multi-brand firm quotes with at least one of its brands in every price set (AXA and Esure do not quote for the unemployed), but the third and fourth columns show that it may not be with all their brands (the exceptions are Esure, Hastings and the BGL Group, while Fresh never quotes with all of its brands). This is explored further in Appendix A, which shows that some firms do not quote some brands for some types, such as the young, unemployed, male or retired, but overall there is no consistent pattern.

The multi-brand firm may also engage in branding by advertising its 'leading brand'. The fifth column of Table 1 reveals that on average the multi-brand firms spend the same on advertising per brand as the single-brand firms (£61.08m / 62 = £0.99m and £21.14m / 21 = £1.01m respectively), so that there is no relationship between advertising and the number of brands (r = -0.08). However, the sixth column shows that 82% of this advertising is on the 'leading brand' (£50.20m of £61.08m), so that little money is spent on building the profile of more than a single brand for most firms. Only three multi-brand firms spend more than £1m on their other brands, of which RBS still spends 92% on its leading brand. McDonald and Wren (2012) find that brand advertising in the UK motor insurance market is primarily about

[8] Typically, the insurance specialist provides the pricing strategy, an underwriting panel of insurers, policy administration and marketing. The BGL Group is an insurance broker that has deals with banks (HSBC, Halifax, Lloyds TSB and Bradford and Bingley) and well-known firms (Post Office, Auto Trader, Marks and Spencer, RAC and Yes Insurance), Ageas with Kwik-Fit and John Lewis, and BDML with Asda, Virgin and Debenhams.

name recognition for informative purposes, but that a firm may persuasively advertise some brands (Smith and Brynjolfsson, 2001), perhaps to price discriminate between consumers.

4. The Price Rankings

The mean and coefficient of variation of the price data are given in Table 2 for the multi- and single-brand firms. This is for all 440 price sets, disaggregated by the car type. It shows that the multi-brand firms tend to post lower mean prices compared to the single-brand firms, and that they are also less dispersed, although the differences are not significant. In fact, the raw price data may not provide a good measure of price clustering, which is about prices having a similar rank in the price distribution, so that the rank r_{ijt} of price i in sub-market j at time t is used instead. Since the price sets have a different number of quotes, these data are further transformed using the Hazen Rule plotting position (Cox, 2005):

$$RANK_{ijt} = \frac{(r_{ijt} - 0.5)}{n_{jt}}. \qquad (1)$$

where n_{jt} is the number of brands in sub-market j at time t. The Hazen plotting position has attractive features as in each price set it is in the range (0, 1), the median rank is 0.5 and the distribution of plots around this median is symmetric. A lower-ranked price for brand i in j at time t gives a smaller value of $RANK_{ijt}$. It gives the same ranking as other rules such as the Weibull and Percent Rank Rules, while in cardinal terms it lies between these.[9]

The pricing behaviour of the multi-brand firms is our key interest, and the mean of the

[9] The Hazen Rule is a member of a family of plotting positions, $(r_{ijt} - a) / (n_{jt} - 2a + 1)$, for which $a = 0.5$, while the Weibull Rule is $a = 0$. There is no qualitative difference if the analysis is repeated for the Weibull Rule. The observed n_{jt} varies between 44 and 79, for which the variance of $RANK_{ijt}$ varies between 0.08 and 0.09.

price rankings for each of these sixteen firms is examined in Table 3. The Hazen Rule has a mean price ranking of 0.5, but the second column shows that only seven of the multi-brand firms has a mean ranking across the price sets that is less than this. This does not necessarily refute hypothesis H1 as the other nine multi-brand firms use some of their brands to pursue other strategies, of which all but one has at least three brands. In particular, two multi-brand firms have affinity deals (Ageas and BDML), three heavily-advertise a single brand (RSA, Admiral and RBS) and two rarely post all of their brands in a single price set, if at all (A&A Group and Fresh), while the MMA Group openly declares ownership.

The third column of Table 3 calculates the variance of the price rankings in each price set for all of the brands of each multi-brand firm, reporting the mean value. As the expected value of the sample variance is equal to the population variance (Mood *et al*., 1974), it can be compared with all of the firms under a one-tailed t-test (Kazmier and Pohl, 1987). This is a more stringent test than comparing them with the single-brand firms only. It shows that half the multi-brand firms have a significantly smaller variance than the population variance at the 5% level, and that it is significantly greater for none. Again, it does not control for the other strategies that might be pursued, but it offers some tentative support for hypothesis H2.

Price clustering can be further explored by calculating the correlation coefficient of the price rankings for each pair of brands of a multi-brand firm across the price sets in which they both quote. The final column of Table 3 gives the mean correlation for each firm and it shows they are generally positive, so that the brands are posted at a similar ranking. The distribution of the pairwise correlation coefficients of the rankings is shown in Figure 2. Part (a) is for all 83 brands, and it resembles a normal distribution but with a fat tail on the right-hand side, indicating that some brands have strong positive correlation in their rankings. Part (b) is the distribution for the multi-brand firms and it shows that these account for the fatter tail.[10] A

[10] Excluding the BGL Group, which has twelve brands, the multi-brand firm correlations are always positive.

two-sample test shows that the multi-brand firm distribution is significantly different to all firms ($\chi^2 = 0.61$; $p = 0.00$). It is also the case relative to the single-brand firms.

Finally, Table 4 focuses on the lowest-priced brands in a price set, where the number of these ranges between 2 and 10 prices. It shows the multi-brand firms are over-represented in the lowest prices, with the mean number of brands per firm across the columns of Table 4 lying between 1.37 and 1.56. This implies that there is some clustering at the lowest prices. The change in the mean number of firms increases after about six prices, consistent with the above evidence for the size of the consideration set. Overall, the raw price ranking data offer some support for hypothesis H2, but that for H1 is much less clear. However, as we have seen, these multi-brand firms pursue other strategies with at least some of their brands, and so we now turn to the regression analysis in order to control for these strategies.

5. Regression Analysis

The regression model is specified as:

$$RANK_{ijt} = \beta_0 + \beta_1 MULTI_{ij} + \beta_2 STRATEGY_{ij} + \beta_3 ATTRIBUTE_{ij} + \delta_j + \delta_t + \varepsilon_{ijt},\ \varepsilon_{ijt} \approx N(0, \sigma_{ijt}^2)$$

$$\text{and } \sigma_{ijt} = \sigma + \lambda_1 MULTI_{ij} + \lambda_2 STRATEGY_{ij} + \lambda_3 ATTRIBUTE_{ij} + \delta_j + v_{ijt}, \qquad (2)$$

where $RANK_{ijt}$ is defined by equation (1) as the Hazen Rule plotting position of price i in sub-market j at time t. $MULTI_{ij}$ is a dummy variable for multi-brand firm ownership, $STRATEGY_{ij}$ includes terms for the other strategies pursued by the firm that posts price i, $ATTRIBUTE_{ij}$ are brand- and firm-level attributes, δ_j and δ_t are sub-market and time fixed effects, and ε_{ijt} is the error term. Brand dummies are not included since this would involve dropping *MULTI*, but this is explored below. Equation (2) is estimated across all of the prices posted by both multi-

brand and single-brand firms. While the decision to be a multi-brand firm is strategic, no multi- or single-brand firm changes its status in this regard over the study period.

Equation (2) is advantageous as the coefficients on the regressors are estimated both for the conditional mean function and for the variance of the unexplained component. The interest is in the coefficients on *MULTI*, where hypothesis H1 is equivalent to testing $\beta_1 < 0$, i.e., multi-brand firms post lower prices, and hypothesis H2 is equivalent to $\lambda_1 < 0$. The latter is because there is an unexplained component to a price rank, so that $\lambda_1 < 0$ implies that the variance of this component is smaller for multi-brand firms and the dispersion of the rankings is correspondingly smaller, i.e., there is greater price clustering. The tests relate to the multi-brand firms as a whole, but β_1 and λ_1 are also estimated below for each of these.

As regards the *STRATEGY* and *ATTRIBUTE* terms in equation (2) details of these are given in Appendix B, including the descriptive statistics for the multi- and single-brand firms. The *STRATEGY* terms control for the branding activities of firms, such as the differentiation of the brands through advertising. Advertising is mainly about name recognition (McDonald and Wren, 2012), but the advertising of a leading brand may be for persuasive purposes, so that two terms are included for this, and they are expected to have negative and positive signs respectively. A term is included for market segmentation, whereby a firm posts its brands in some sub-markets only, and also terms for an affinity deal and for the open declaration of a brand's ownership. Most of these strategy terms are not relevant to the single-brand firms, so that their main purpose is to capture the other strategic purposes to which a multi-brand firm may put some or all of its brands that would inhibit its ability to obfuscate search.

The *ATTRIBUTE* terms control for the firm market share, the underwriting behaviour, insurance brokers and consumer satisfaction, as well as product attributes that are displayed on *confused.com* alongside the price, such as the excess amount (Appendix B). The attributes are included to capture their effect on the quoted price, which includes the possibility that a low-

priced brand is not included in the consideration set since it is too basic. The brand-level attributes may be used by a consumer to evaluate the consideration set at the second stage of search, but this is not our main interest. Firm-level attributes may also affect the quoted price and these include a market share term for economies of scale. This and the advertising data are lagged one year, so that they are not determined simultaneously with the price.

5.1 The estimation results

Equation (2) was estimated across the 28,327 price observations, of which 6,223 are for the single-brand firms. This is using maximum likelihood (Gould *et al*., 2010), where Davidson and MacKinnon (1993) show that the respective β and λ estimates are identified from each other. The error terms ε_{ijt} are clustered by the sub-market to control for the non-independence of the observations over time. The results are presented in Table 5, where to save space the estimates for the brand attributes are not reported.[11] The time fixed effects are insignificant. Qualitatively similar results are obtained if equation (2) is estimated separately for each of the four dates. Focusing on the estimates of β, column I of Table 5 shows that the *STRATEGY* terms are each significant at the 1% level. Informative advertising gives lower prices, but the other strategies lead to a higher price rank, so that these all conform to prior expectations.

The β estimates on the *ATTRIBUTE* terms are also significant in column I of Table 5. They each have the correct sign, except for the market share term, which has a positive effect on the price ranking. It was noted above that the UK motor insurance market is characterised by a low concentration and Appendix B shows that the mean market share is just 3.9% for the multi-brand firms (i.e., a brand share of 1.01%, against 0.92% for single-brand firms). This suggests that scale economies are unimportant for the UK motor insurance, so that the sign on

[11] These attributes are each significant at the 1% level, where as expected they show that greater consumer satisfaction, a higher excess, a courtesy car and additional insurance cover all lead to a higher price rank.

market share may just arise since firms with higher sales have more loyal consumers and can offer higher prices (Jing and Wen, 2008).[12] As regards the λ estimates, a lower price ranking from informative advertising leads to greater price clustering, but the opposite is the case for persuasive advertising and market segmentation. Affinity deals lead to more price clustering, and this is possibly because nine of these deals relate to a single firm, the BGL Group.

5.2 The results for the multi-brand firms

The estimates on the *MULTI* terms in column I of Table 5 are negative and significant. Thus, having controlled for the other strategies to which some brands can be put and the attributes it implies that the multi-brand firms post prices that are low and clustered relative to the single-brand firms, so that hypotheses H1 and H2 cannot be rejected. These effects are strong as the multi-brand firms have an estimated mean price ranking for their brands of 0.25, compared to the median Hazen ranking of 0.50. The error variance is also reduced by about a half.

The remainder of Table 5 examines the robustness of the estimated coefficients on the *MULTI* terms. Column II omits the persuasive advertising term, which interacts the *MULTI* and advertising terms (Appendix B), but the estimated coefficients on *MULTI* continue to be negative and significant, albeit smaller in magnitude. Further, qualitatively similar results are obtained if persuasive advertising is instead measured by a dummy variable for the most heavily-advertised brand of each multi-brand firm. Column III omits all of the *STRATEGY* terms and the estimated coefficients on *MULTI* are again smaller in magnitude, which in this case is consistent with the unconditional analysis of the price data in Section 4. Column IV omits the *ATTRIBUTE* and fixed effects and the estimated coefficients on the *MULTI* terms are

[12] We also rule out unobserved heterogeneity as an explanation for our results below, and since hypothesis H3 is not rejected above then it suggests that economies of scale alone cannot be an explanation for our results.

again robust to this. This is also the case in column V, where *RANK* is transformed using the logistic function to ensure that the predicted values of rank lie on the unit interval. In this case the marginal effects for β_1 and λ_1 are -0.383 and -0.234 respectively. Finally, if equation (2) is estimated separately by the car type or by the date, or if *MULTI* is replaced by a term for the number of brands offered by each firm, then the same conclusions are drawn.

To get some idea of where the multi- and single-brand firms post their prices, Figure 3 graphs as density functions the predicted values of *RANK* based the estimates in column V of Table 5. It shows that the multi-brand firms post prices across the distribution, but that once the other strategic purposes to which a brand may be used are controlled for then the brands are posted at relatively low and clustered prices. This is in contrast to the single-brand firms, for which some firms post low prices and others post a high price. The high prices probably just capture the consumers that search at a single price only. Further, given the prevalence of price-parity clauses, it could reflect the offline behaviour of some of these single-brand firms, although it is not found for the multi-brand firms, for which the prices are low and clustered.

5.3 Search obfuscation

As part of the identification strategy, it was noted in Section 2 that there could be alternative explanations for the results that arise from unobserved heterogeneity. First, it is argued that unobserved brand heterogeneity could explain why the multi-brand firms pitch their brands at similar prices and conceal their ownership, although if this was the case it would be expected to occur throughout the price distribution, so that hypothesis H1 would not hold once the brand heterogeneity is controlled for. This is done using brand fixed effects, but as noted above, it is not possible to include both the *MULTI* term and brand fixed effects in the same regression, so a two-step procedure is used. First, equation (2) was re-estimated with all of the variables, except the *MULTI* term, but with a dummy for each brand to control for the heterogeneity.

Second, the fitted values from this were regressed on the *MULTI* term only. The negative and significant estimate obtained for the coefficient on this term implies that, after controlling for brand heterogeneity, the multi-brand firms still set lower prices and that hypothesis H1 cannot be rejected, so that brand heterogeneity is not an explanation for the results.

Second, it was argued above that unobserved firm heterogeneity could explain why a multi-brand firm clusters its prices (e.g., costs common to a firm's brands could lead it to post its prices at a similar rank in a sub-market), although if this was the case the clustering would be expected to occur throughout the price distribution. To examine this, equation (2) was re-estimated with the error variance term σ_i^2 freely determined. The square of these residuals from this were then regressed on all of the same variables plus an interaction term between *MULTI* and *RANK*. However, the positive and significant estimate obtained for the coefficient on this interaction term implies that the multi-brand firms' prices as a whole are more clustered at lower prices than higher prices. Again, this is consistent with search obfuscation, and it shows that unobserved firm heterogeneity is not explanation for the results.

Overall, the regression results reveal that as a whole the multi-brand firms post prices that are relatively low and clustered, and that this cannot otherwise be explained. To examine if this behaviour holds for each multi-brand firm equation (2) was estimated with the *MULTI* terms allowed to vary across these firms. The estimated coefficients for the *MULTI* terms are presented in Table 6, and they show that virtually every multi-brand firm posts prices that are significantly lower and clustered. Interestingly, it is not satisfied for the MMA Group, which discloses its brand ownership. These results suggest that search obfuscation is pervasive once the other strategic objectives are controlled for. Of course, a consideration set is likely to be relatively small, and we have seen that not every multi-brand firm can pitch its brands in such a set, so that we close by giving some rationalisation for this apparent paradox.

In general, we believe that the desire for firms to post prices that are low and clustered

reflects the complexity of the online motor insurance market, about which the firms are likely to be imperfectly informed. This complexity arises as the consideration sets differ between consumers due to their characteristics, such as driving history, coverage and car type, while a firm's competitors can change their prices and introduce new brands with ease. It means that by pitching its brands at low prices a firm can get at least some of its brands into at least some consideration sets. Given the criteria for forming these sets there is no advantage to charging higher prices as it leads to administrative complexity, so that these higher prices are found for single-brand firms. Of course, it may be that consumers do not base their consideration sets solely on the price, but given that the UK motor insurance comparison sites each present the search results in an ascending price order, it is likely to be an important consideration.

7. Conclusions

Reflecting the growth of Internet markets and a reduction in consumer search costs, attention has focused on the ways firms can strategically innovate to gain a competitive advantage by obfuscating consumer search. In this paper it is argued that the marketing devices considered by the literature are less applicable to online markets if the consumers form consideration sets using the lowest-ranked prices. It considers the possibility that a firm can use multiple brands to obfuscate search, since by excluding the brands of other firms from the consideration set it can increase the chance that one of its own products is chosen. This requires that the brand ownership is concealed, which signals reputation and trust, and if revealed it might otherwise cause the consumer to swiftly discount all but the cheapest brand from the same firm. The use of multiple brands, and the concealment of ownership as a method of search obfuscation, has been previously modelled in the literature, but in the context of an offline market.

The paper analyses data from a leading price comparison website for the UK online

motor insurance market. It finds that three-quarters of the brands listed on this site are owned by just sixteen firms and that the ownership of these brands is almost never openly declared. Controlling for the product attributes and other strategies to which a firm may use its brands, it finds that the multi-brand firms offer prices that are significantly lower than for the single-brand firms and that they cluster these prices at a similar ranking in the price distribution. It is evident for virtually every multi-brand firm and inconsistent with alternative explanations that rest on unobserved heterogeneity, such as common costs, learning or beliefs about risk. It relies on consumers using the lowest-ranked price to form their consideration sets, but this is supported by other evidence and by the presentation of the search results on a comparison site, even after filtering. As such, the empirical results offer strong support for the notion that firms use multiple brands in online markets to obfuscate consumer search.

Search obfuscation through multi-brand pricing is believed to be a new form of firm strategic behaviour that has not previously been observed in online markets. It gives the firm increased market power and it is harmful to consumers if their search is made less effective. Since not all firms can make the consideration set it is not optimal for all firms to engage in this behaviour, and we find that some firms offer a single brand at a higher price only, while market complexity is likely to hinder the ability of a firm to pitch its brands in every set. The implication of the paper is that the number of prices in an online market will not reflect its competitiveness, suggesting that these markets are less competitive than previously supposed. Search obfuscation using multiple brands may be more difficult to ascertain in other markets, where there are very many small sellers, such as in electronics, books or tourism. However, the opaqueness of brand ownership, and the ease with which the firms can post prices online under different brand names, suggests that it is likely to be pervasive in these markets.

Table 1: The Multi-Brand Firms

Firm	Number of Brands	Price Sets			Advertising Expenditure	
		In which Firm Quotes (%)	With all Brands[a] (%)	Mean Number of Brands[a]	Firm-level (£'m)	Leading Brand (%)
Europa	2	99.6	23.1	1.23	0	-
Zurich	2	99.8	36.9	1.37	0.10	100.0
Brightside	2	99.8	66.7	1.67	0.01	100.0
RSA	2	94.3	46.5	1.71	5.93	99.5
AXA	2	54.8	75.1	1.75	9.55	63.4
Esure	2	69.1	99.0	1.99	1.79	57.5
A&A Group	3	98.6	9.0	1.55	0	-
Fresh	3	96.6	0.0	1.75	0	-
Acromas	3	100.0	24.8	2.24	14.53	68.6
Admiral	4	98.4	48.5	3.34	5.78	99.1
RBS	4	100.0	46.6	3.46	17.56	92.7
Hastings	4	100.0	99.3	3.99	0.64	100.0
MMA Group	5	90.9	49.0	4.41	2.51	100.0
BDML	6	100.0	16.8	4.39	0.06	50.0
Ageas	6	100.0	50.9	5.45	0.03	66.7
BGL Group	12	100.0	96.1	11.93	2.59	75.3
Multi-Brand Firms	62	93.9	49.3	52.23	61.08	82.2
Single-Brand Firms	21	57.9	100.0	12.15	21.14	-
All Firms	83	75.5	78.1	64.38	82.22	-

Note: [a] Calculated for price sets in which firm quotes at least one price.
Source: Authors' dataset for *confused.com* enquiries and Nielsen Company for advertising data at 2010.

Table 2: The Mean and Dispersion of Prices by Car Type

Car type:	Fiesta	Focus	Vectra	BMW	MX-5
Mean Price:					
All Brands	£626	£713	£977	£1,217	£929
Single-Brand Firms	£647	£738	£1,044	£1,192	£963
Multi-Brand Firms: All brands	£620	£705	£959	£1,224	£920
(*Relative to Single Brand*)	(*95.8%*)	(*95.5%*)	(*91.9%*)	(*102.7%*)	(*95.5%*)
Multi-Brand Firms: Lowest brand	£577	£671	£912	£1,080	£852
(*Relative to Single Brand*)	(*89.2%*)	(*90.9%*)	(*87.4%*)	(*90.6%*)	(*88.5%*)
Coefficient of Variation:					
All Brands	0.436	0.444	0.415	0.375	0.436
Single Brand Firms	0.382	0.417	0.467	0.395	0.471
Multi-Brand Firms	0.430	0.434	0.379	0.356	0.396
(*Relative to Single Brand*)	(*112.6%*)	(*104.1%*)	(*81.2%*)	(*90.1%*)	(*84.1%*)

Note: The difference between the multi-brand and single-brand firms is not significant in each case.
Source: Authors' dataset.

Table 3: Price Rankings of the Multi-Brand Firms

Firm	Number of Brands	Mean Price Ranking	Mean Variance of Price Ranking[a]	Mean Correlation Coefficient[b]
Europa	2	0.397	0.214	-0.12
Zurich	2	0.451	0.001***	0.99
Brightside	2	0.443	0.060	-0.41
RSA	2	0.866	0.008***	0.36
AXA	2	0.504	0.008***	0.80
Esure	2	0.025	0.001***	0.77
A&A Group	3	0.651	0.043	0.36
Fresh	3	0.678	0.156	0.22
Acromas	3	0.256	0.050	-0.41
Admiral	4	0.548	0.001***	0.99
RBS	4	0.573	0.029**	0.36
Hastings	4	0.277	0.027*	0.79
MMA Group	5	0.620	0.052	0.46
BDML	6	0.681	0.034**	0.41
Ageas	6	0.511	0.087	0.06
BGL Group	12	0.446	0.023***	0.61
All firms	83	0.500	0.085	-0.01

Notes: Hazen price rankings. [a] Mean variance of rankings for the price sets in which firm quotes. Significance test is for paired observations of multi-brand and all firms across price sets under a one-tailed t-test. *** = significant at 1%, ** = 5% and * = 10% level. [b] Calculated for the price rankings for each pair of a firm's brands across price sets in which both prices are posted.
Source: Authors' dataset.

Table 4: Lowest-Priced Brands and the Number of Firms

Number of lowest-priced brands:	2	3	4	5	6	7	8	9	10
Mean number of firms	1.46	2.18	2.90	3.50	4.06	4.62	5.20	5.82	6.43
Mean number of brands per firm	1.37	1.38	1.38	1.43	1.48	1.52	1.54	1.55	1.56
Change in the number of firms	-	0.72	0.72	0.60	0.56	0.56	0.58	0.62	0.61

Notes: Calculated across 440 price sets for *confused.com* enquiries.
Source: Authors' dataset.

Table 5: Regression Results for the Brand Price Ranking

Dependent Variable: *RANK*	Maximum Likelihood				Logistic
	I	II	III	IV	V
Constant (β_0)	0.868***	0.815***	0.811***	0.607***	2.433***
MULTI (β_1)	-0.249***	-0.159***	-0.013***	-0.233***	-1.531***
STRATEGY (β_2):					
Informative Advertising	-0.024***	-0.007***	-	-0.016***	-0.139***
Persuasive Advertising	0.021***	-	-	0.015***	0.120***
Market segmentation	0.626***	0.570***	-	0.655***	3.889***
Affinity deal	0.151***	0.154***	-	0.085***	0.882***
Declaration of ownership	0.221***	0.201***	-	0.180***	1.186***
ATTRIBUTE (β_3):					
Market share	0.009***	0.009***	0.008***	-	0.051***
Underwriting behaviour	-0.120***	-0.054***	-0.073***	-	-1.374***
Insurance broker	-0.202***	-0.032***	-0.008	-	-1.292***
Constant (σ)	0.249***	0.258***	0.235***	0.335***	1.849***
MULTI (λ_1)	-0.120***	-0.088***	-0.070***	-0.093***	-0.935***
STRATEGY (λ_2):					
Informative Advertising	-0.008***	0.002***	-	-0.004***	-0.059***
Persuasive Advertising	0.013***	-	-	0.007***	0.084***
Market segmentation	0.210***	0.179***	-	0.120***	1.259***
Affinity deal	-0.042***	-0.043***	-	-0.038***	-0.460***
Declaration of ownership	-0.005	-0.006	-	-0.008*	-0.119***
ATTRIBUTE (λ_3):					
Market share	-0.004***	-0.005***	-0.004***	-	-0.034***
Underwriting behaviour	0.075***	0.175***	0.134***	-	1.061***
Insurance broker	0.004	0.112***	0.088	-	0.512***
ATTRIBUTE and δ_j and δ_t fixed effects?	Yes	Yes	Yes	No	Yes
Log Likelihood	-1,031.66	-1,620.79	-2876.52	-3154.18	-51,052.2
χ^2	8,192.43	5,683.29	4,029.36	2992.86	6,911.11
Observations	28,327	28,327	28,327	28,327	28,327

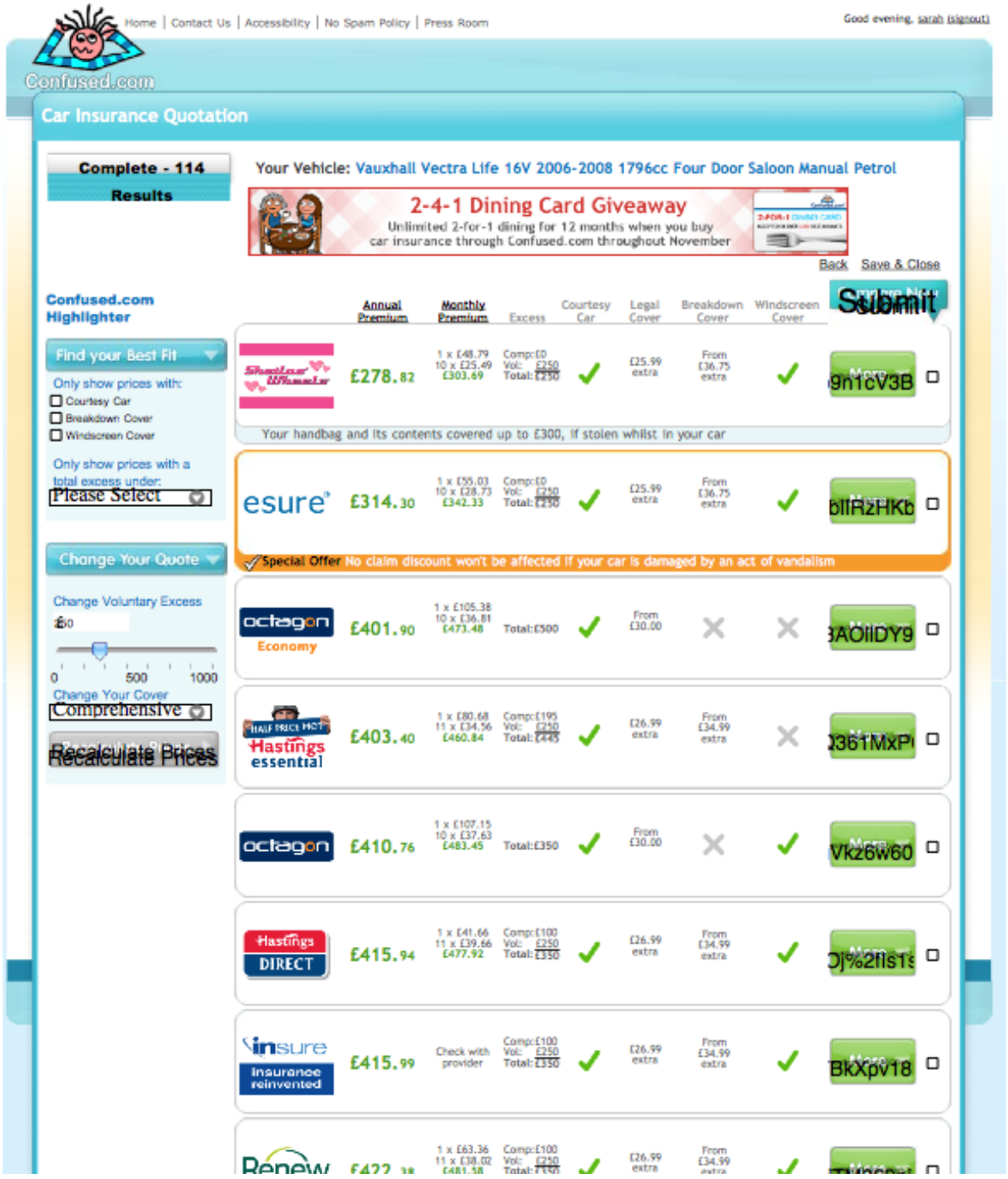
Note: Estimation of equation (2) with standard errors clustered by sub-market. Policy details in *ATTRIBUTE* and δ_j are included in both parts in all columns but not shown. *** = significant at 1%, ** = 5% and * =10% level.

Table 6: Coefficient Estimates for Each Multi-Brand Firm

Firm	Number of Brands	β_I	λ_I
Europa	2	-0.205***	-0.017*
Zurich	2	-0.333***	-0.038***
Brightside	2	-0.153***	-0.137***
RSA	2	-0.059***	-0.256***
AXA	2	-0.315***	-0.150***
Esure	2	-0.715***	-0.343***
A&A Group	3	-0.039***	-0.112***
Fresh	3	0.062***	-0.022**
Acromas	3	-0.468***	-0.159***
Admiral	4	-0.483***	-0.136***
RBS	4	-1.113***	-0.179***
Hastings	4	-0.364***	-0.115***
MMA Group	5	0.034***	-0.079***
BDML	6	0.053***	-0.150***
Ageas	6	-0.328***	-0.022*
BGL Group	12	-0.206***	-0.153***
Log Likelihood		2,704.51	
χ^2		105,929.7	
Observations		28,327	

Note: Re-estimation of column I of Table 5 with *MULTI* in spline form.
*** = significant at 1%, ** = 5% and * = 10% level.

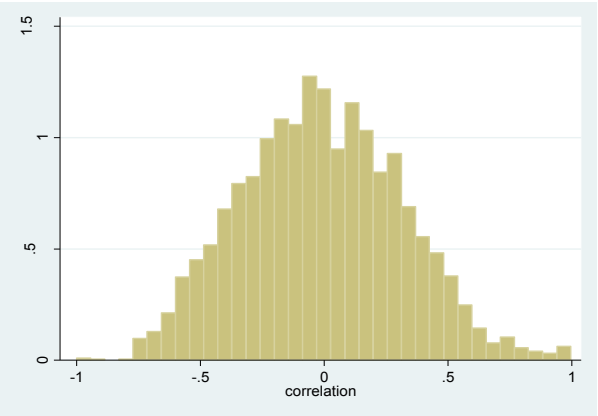
Figure 1: Screen Shot of *Confused.com* Search Results



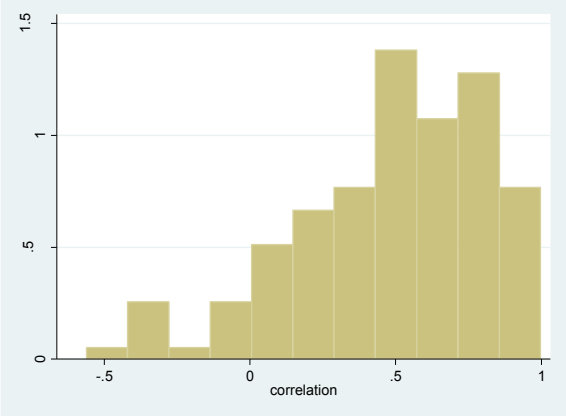
Note: Search results for given individual type, and car type as specified in figure. 114 results in total.

Figure 2: Distribution of Correlation Coefficients for Brand Rankings

(a) All Firms

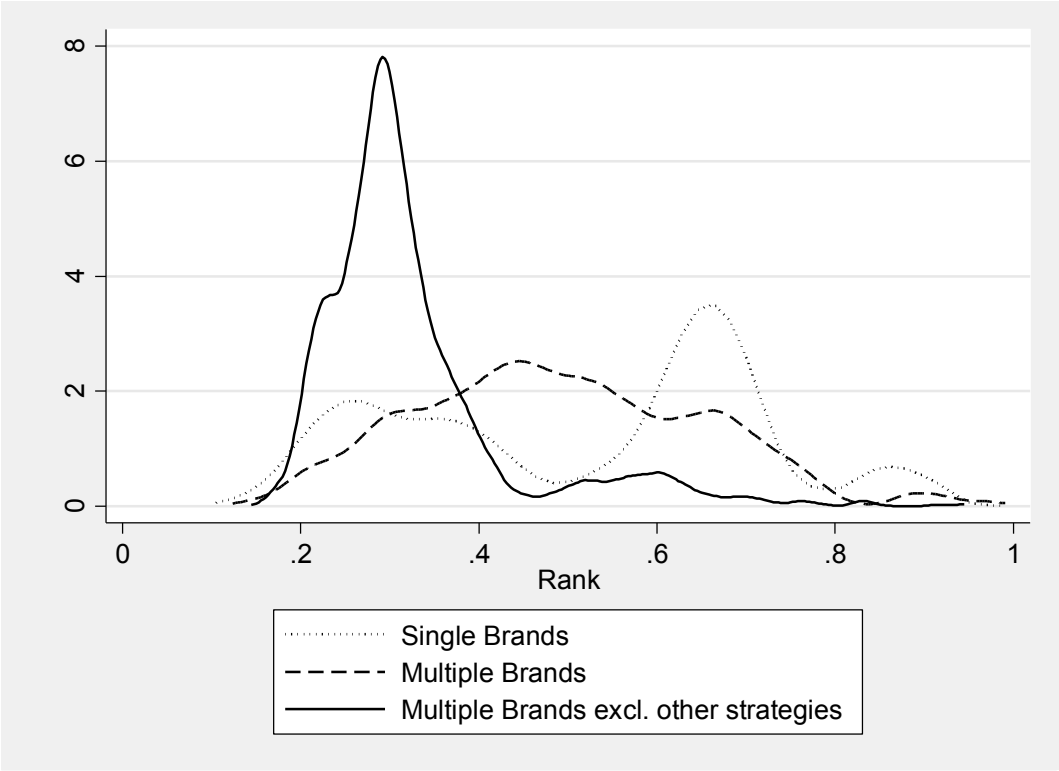


(b) Multi-Brand Firms



Note: Calculated on the same basis as final column of Table 3. There are 3,403 comparisons in part (a).

Figure 3: Predicted Values of the Price Rank



Note: Predicted value of *RANK* from column V of Table 5, expressed as a density function and smoothed using kernel density methods. Other strategies are the *STRATEGY* terms in Appendix B.

Appendix A: Mean Number of Brands Posted by Individual Characteristics

Firm	Number of Brands	Age (years)				Occupation				Sex	
		25	40	55	70	Unemployed	Factory Worker	Computer Consultant	Retired	Male	Female
Europa	2	1.20	1.24	1.24	1.25	1.23	1.22	1.24	1.25	1.23	1.22
Zurich	2	1.38	1.36	1.37	1.38	1.37	1.37	1.36	1.38	1.00	1.74
Brightside	2	1.58	1.69	1.69	1.75	1.70	1.63	1.63	1.74	1.68	1.66
RSA	2	1.58	1.73	1.75	1.75	1.66	1.71	1.71	1.75	1.69	1.73
AXA	2	1.98	2.00	1.67	1.00	-	2.00	1.99	1.00	1.75	1.75
Esure	2	1.98	1.99	1.99	2.00	-	1.98	1.99	2.00	1.99	1.99
A&A Group	3	1.74	1.73	1.38	1.00	1.17	1.90	1.91	1.00	1.54	1.55
Fresh	3	1.75	1.75	1.76	1.75	1.75	1.75	1.76	1.75	1.75	1.76
Acromas	3	1.99	2.00	2.62	2.23	2.08	2.33	2.33	2.24	2.24	2.25
Admiral	4	3.38	3.37	3.43	3.39	3.39	3.38	3.40	3.44	2.84	3.98
RBS	4	2.98	3.49	3.72	3.73	3.38	3.40	3.41	3.74	3.45	3.47
Hastings	4	3.98	3.99	3.99	4.00	3.95	4.00	4.00	4.00	3.97	4.00
MMA Group	5	4.25	4.48	4.47	4.45	4.36	4.43	4.41	4.45	3.82	4.89
BDML	6	4.20	4.34	4.49	4.75	3.63	4.64	4.68	4.74	4.35	4.44
Ageas	6	5.38	5.53	5.55	5.00	4.78	5.76	5.81	5.43	5.39	5.50
BGL Group	12	11.97	11.91	11.94	11.95	11.97	11.97	11.88	11.94	11.95	11.93
Total	62	48.38	50.36	51.39	50.83	45.54	52.07	52.35	51.36	48.38	52.09

Note: Disaggregation of the fourth column of Table 1 for the mean number of brands posted across the price sets in which the firm quotes.

Appendix B: Variables and Descriptive Statistics

Variable	Mean	Standard Deviation	Mean	
			Multi-Brand	Single-Brand
MULTI	0.75	0.44	1	0
STRATEGY:				
Informative Advertising (£'m, log)	0.99	2.70	0.99	1.02
Persuasive Advertising (£'m, log)	0.74	2.40	0.99	0.00
Market segmentation	0.12	0.14	0.16	0.00
Affinity deal	0.17	0.38	0.23	0.00
Declaration of ownership	0.06	0.24	0.08	0.00
ATTRIBUTE:				
(a) Firm-level:				
Market share (%)	3.15	6.20	3.90	0.92
Underwriting behaviour	0.35	0.48	0.40	0.19
Insurance broker	0.63	0.49	0.60	0.71
(b) Brand-level:				
Consumer satisfaction (1 to 10)	4.61	8.74	4.53	4.85
Consumer survey missing data	0.70	0.46	0.66	0.80
Excess amount / deductible (£)	187	121	187	188
Courtesy car	0.93	0.26	0.90	0.99
Legal fees cover	0.23	0.41	0.25	0.18
Breakdown cover	0.07	0.25	0.05	0.13
Windscreen damage cover	0.95	0.21	0.95	0.95

Note: Calculated across brands. Dummy variables unless otherwise indicated in parentheses.

Advertising is assumed to be for informative purposes, except that the multi-brand firms tend to heavily advertise a leading brand only, which is persuasive advertising. This is measured by interacting advertising with the *MULTI* dummy. The advertising data are for 2010 and are obtained from the Nielsen Company. There is no consistent pattern for market segmentation in Appendix A, so that it is measured at the firm level by the frequency of price posts. This is based on columns one and four of Table 1, as follows:

$$\text{Frequency of price posts} = \frac{(\text{number of brands - mean number of posts per price set})}{\text{number of brands}}.$$

If a firm posts its brands less frequently then a higher price rank is expected, so that $\beta_2 > 0$ in

equation (2). The frequency is zero for single-brand firms. Higher prices are expected for an affinity deal as the non-specialist brand will seek a return for the use of its name, and for the declaration of ownership on *confused.com* as the brand is not being used to obfuscate search, which removes the incentive for a lower price. The market share is at the firm level at 2010 and sourced from Mintel (2012). It is not available at the brand level. It is measured by the gross underwritten premium, but as this understates the sales of firms that do not underwrite premiums, a dummy is included for the firms with a reported market share of less than 1%. Insurance brokers have higher costs and so a dummy variable is also included for these.

Consumer satisfaction is an index that goes from 1 to 10 (10 is greatest satisfaction). It is measured at 2011 and sourced from Auto Express (2012). A dummy is included for the missing cases. A higher level of customer service is associated with a service premium and a higher price. Other brand-level attributes are sourced from *confused.com*. It can be seen that most brands offer a standardised bundle of attributes that include and windscreen cover and a courtesy car, but exclude breakdown cover. There is some variation in whether the legal fees cover is included as standard, but there is little attempt to use these attributes to vertically differentiate. In general, the β coefficients can be signed *a priori*, but it is not possible for the λ as it depends on where in the price distribution the brands that are affected are positioned, possibly leading to greater price dispersion if at the tails, and conversely.

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